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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/437,006	11/09/1999	TAMMY ZHENG	PHA 51219	7398

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EXAMINER

CHEN, KIN CHAN

ART UNIT	PAPER NUMBER
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1765

DATE MAILED: 03/30/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/437,006

Applicant(s)

ZHENG ET AL.

Examiner

Kin-Chan Chen

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 17 February 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1 and 3-21 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1, 3-18 and 21 is/are rejected.
- 7) ☒ Claim(s) 19 and 20 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### ***Claim Rejections - 35 USC § 112***

1. Claims 1, 3-18 and 21 are rejected under 35 U.S.C. 112, first paragraph, as based on a disclosure which is not enabling. The first and second etching chemistries are critical or essential to the practice of the invention, but not included in the claim(s) is **not enabled by the disclosure**. See *In re Mayhew*, 527 F.2d 1229, 188 USPQ 356 (CCPA 1976). Claims do not set forth first and second etching chemistries involved in the method/process, which is critical to produce results that minimize notching in pillar structure without affecting selectivity in the plasma etching process. Therefore, the scope of protection provided by the claim is not adequately enabled by the description of the invention provided in the specification of the application. The scope of the claim goes beyond the scope justified by the description of the invention provided in the specification and drawings.

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1, 3-18, and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Grimbergen et al. (US 6,081,334; hereinafter "Grimbergen") in view of Witek et al. (US 5,627,395; hereinafter "Witek").

In a process of forming a semiconductor device, Grimbergen teaches that a least one device layer (e.g., polysilicon) and an anti-reflective coating may be formed over a wafer surface. A hard mask may be provided over a portion of the device (col. 5, lines 51-67, Figs. 1a and 1b). A plasma-etch may be applied using first and second etching chemistries and selectively etching into the device layer to form a pillar structure (such as gate electrode) having at least one sidewall. The first chemistry may include  $\text{HBr}$ ,  $\text{Cl}_2$ ,  $\text{He-O}_2$ . After using the first chemistry, a plasma-etch using a second chemistry may be performed. The halogen content of the etchant gas may be reduced to obtain slower and more controllable etch rates (col. 18, lines 15-30) in order to stop the etching process without etching through the silicon dioxide underlayer on the substrate (col. 18, lines 15-17).

Unlike the claimed invention, Grimbergen does not teach using nitrogen, rather, Grimbergen teaches using Helium ( $\text{He}$ ) in the second etching chemistry. Grimbergen teaches, after using the first chemistry, using a plasma-etch of a second chemistry that the halogen content of the etchant gas may be reduced to obtain slower and more controllable etch rates in order to stop the etching process without etching through the silicon dioxide underlayer on the substrate. In a method of polysilicon etching, Witek teaches that  $\text{HBr}$  and  $\text{Cl}_2$  are generally used and the inert gas such as  $\text{Ar}$ ,  $\text{He}$ , or nitrogen may be used. It would have been obvious to one with ordinary skill in the art to use nitrogen of Witek in Grimbergen process because Witek teaches the equivalence between using  $\text{He}$  and nitrogen in the processes that are similar to those as taught by Grimbergen wherein polysilicon is etched and because it is well known in the art to use

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nitrogen to reduce the notching . The substitution of one for the other would have been expected to provide the same function and effect in the etching process (such as minimize notching without affecting selectivity) and help provide slower etch rates in the second-stage etching. Furthermore, it is notoriously well known that in the dry etching process, the inert gas is used for diluting the etchant and changes the etching rate (also see Wang et al. (US 6,232,184) in the record as evidence). In addition, Blalock et al. (US 5,783,100) disclose that it is well known in the art to minimize the notching problem by adding nitrogen in the etchant. Hopkins et al. (US 6,187,685) disclose the effect of changing etching rates on the notching. The newly cited references in the record (Blalock et al. and Hopkins et al.) are only as evidences of the prior well-known (or obviousness or conventionality) statements. Furthermore, although the combined prior art does not make mention of the effect on the selectivity, it is expected that the combined prior art would have same effect on the selectivity in the absence of any evidence showing the contrary because the same composition in the combined prior is expected to yield the same result.

A newly discovered property does not necessarily mean the product is unobvious, since this property may be inherent in the prior art. *In re Best* 195 USPQ 430 (CCPA 1977); *In re Swinehart* 169 USPQ 226 (CCPA 1971).

Once a reference teaching product (composition) appearing to be substantially identical is made the basis of a rejection, and the examiner presents evidence of reasoning to show inherency, the burden shifts to the applicant to show an unobvious difference. Whether the rejection is based on "inherency" under 35 U.S.C. §102, or on "*prima facie* obviousness" under 35 U.S.C. §103, jointly or alternatively.

*In re Fitzgerald*, 619 F.2d 67, 70, 205 USPQ 594, 596 (CCPA 1980). See also *In re Best*, 562 F.2d 1252, 1255, 195 USPQ 430, 433-34 (CCPA 1977).

The limitations of dependent claims 4, 9-11, 14, and 21 have been addressed above and rejected for the same reasons, *supra*.

The instant claims differ from Grimbergen and Witek by specifying various nitrogen amount (percent) in the second chemistry (such as claims 1, 3, 5, 7, 8, 15-18). However, a skilled artisan understands that in a plasma etching, the reactive gas content in the etchant gas may be diluted using inert gas in order to obtain slower and more controllable etch rates. Therefore, it would have been obvious to one with ordinary skill in the art to use suitable amount of nitrogen in the process of Grimbergen and Witek in order to obtain slower and more controllable etch rates and stop the etching process without etching through the silicon dioxide underlayer on the substrate.

As to dependent claims 7 and 13, Grimbergen teaches that the first chemistry includes a selectivity booster (such as He-O<sub>2</sub>), see col. 18, lines 22-23.

The above-cited claims differ from the prior art by specifying well-known features (such as SiON hardmask in claim 12) to the art of semiconductor device fabrication. A person having ordinary skill in the art would have found it obvious to modify Grimbergen and Witek by using any of same well-known features to same in order to provide their art recognized advantages and produce an expected result.

It is noted that applicant did not traverse the aforementioned conventionality (e.g., well-known features, obviousness), which have been stated in the office action in Paper No. 16.

***Allowable Subject Matter***

4. Claims 19 and 20 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

***Response to Arguments***

5. Applicant has argued that the combined prior art does not have the same purpose of minimize notching without affecting selectivity. It is not persuasive. As has been stated in the office action, In addition, Blalock et al. (US 5,783,100) disclose that it is well known in the art to minimize the notch problem by adding nitrogen in the etchant. Hopkins et al. (US 6,187,685) disclose that changing etching rates would affect the notching. Furthermore, although the combined prior art does not make mention of the effect on the selectivity, it is expected that the combined prior art would have same effect on the selectivity in the absence of any evidence showing the contrary because the same composition in the combined prior is expected to yield the same result.

**Conclusion**

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Wang et al. (US 6,232,184; col. 3, lines 35-38) teaches that the inert gas may be used for diluting the etchant. Blalock et al. (US 5,783,100; col.2, lines 58-59) disclose that it is well known in the art to add nitrogen to minimize the notching problem. Hopkins et al. (US 6,187,685; col. 2, lines 20-22) disclose that changing etching rates would affect the notching.

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kin-Chan Chen whose telephone number is (571) 272-1461. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on (571) 272-1465. The fax phone number



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for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

March 22, 2004



Kin-Chan Chen  
Primary Examiner  
Art Unit 1765

K-C C